Monitoring and Operational Guidance Handbook for Colorado Public Water Systems Utilizing Hand-Pumped Wells Which Do Not Provide Continuous Disinfection

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Colorado Department
of Public Health
and Environment

This handbook is provided by the State of Colorado for Public Water Systems and addresses requirements for the treatment of public water supplies. This handbook offers monitoring, operation and maintenance criteria for systems in alignment with 13.2(e)(1) of the Colorado Primary Drinking Water Regulations.

Monitoring and Operational Guidance for Colorado Public Water Systems Utilizing Hand-Pumped Wells Which Do Not Provide Continuous Disinfection

1.0 Purpose: To provide an operating procedure that must be used by public water systems that use hand pumps and do not provide continuous disinfection, which will allow their continued operation while protecting the public from microbiological contaminants.

2.0 Applicability: These procedures apply to transient, non-community public water systems using groundwater from hand-pumped wells that cannot provide treatment by means of continuous disinfection. Systems operated and maintained in accordance with this guidance are in compliance with Section 13.2(e)(1) of the Colorado Primary Drinking Water Regulations. Failure to follow these procedures is cause for requiring continuous disinfection or closing the well.

3.0 Background: Hand-Pumped wells are typically shallow wells that do not have a means for providing continuous disinfection of the well water. Hand-Pumped wells are utilized by small, transient non-community public water systems such as campgrounds. Historically, transient, non-community water systems have had a microbiological sampling/testing frequency of once per quarter, during the period of time that the system is open to the public. Department water quality records document microbiological MCL violations at many hand-pumped well systems, indicating that the improved procedures provided by this document are necessary to protect the health of consumers.

4.0 Procedures: Periodic evaluation of water source, proper sampling and testing, and frequent inspections of hand-pumped wells, along with appropriate corrective actions, are required to assure the long-term quality and safety of drinking water. All Regulation 100 Operator duties must be performed by the Operator-in-Responsible Charge (O.R.C.) or by a person trained by and under the supervision of the O.R.C. To avoid monitoring violations the Department should be notified whenever a public water system is temporarily or permanently closed.

4.1 Microbiological Sampling and Testing: Microbiological samples must be analyzed by a Department certified laboratory and all routine and repeat sample results must be submitted to the Department in accordance with the Colorado Primary Drinking Water Regulations. Repeat monitoring, fecal coliform/E.coli testing, analytical requirements, and response to violations shall be in accordance with the Colorado Primary Drinking Water Regulations. For systems that operate more than one hand-pumped well, each well must be individually monitored and treated according to the criteria in this document.

4.1.1 Routine Sampling:

a) For seasonal operations, at least one preopening routine sample must be taken prior to opening for the season. The sample must be taken after completion of start-up procedures but at least ten days prior to providing water to consumers. For example, if a campground opens on June 1st, a routine sample must be taken prior to May 22nd. When results show an absence of bacteria the well may be opened for public use. It is useful to take special purpose samples

to establish an absence of bacteria prior to taking the required routine sample. A sample will be considered a special purpose sample if it is designated so on the sample form prior to being submitted to the laboratory. The first monthly routine sample must be taken within the calendar month the system opens for the season and no more than 7 days after seasonal operation begins. For example, if a campground opens on June 1st the first monthly routine sample must be taken before June 8th. Subsequent monthly samples may be taken on any day of the month.

b) All hand-pumped wells must be sampled at least monthly while in operation.

c) Any time during the operational season that a system raises or lowers the pump stand for maintenance, the well must be disinfected and flushed in accordance with 4.3.4 and a monthly routine microbiological sample must be collected. If the sample shows an absence of bacteria the well may be opened for public use.

d) If any routine sample is total coliform positive, repeat samples must be taken in accordance with 4.1.3 below, and five routine samples will be required the following month.

4.1.2 Sample Collection Procedure:

a) Flush the well by pumping for approximately five minutes.

b) Avoid sample contamination by adhering to the following:
1. The sampling bottle must be kept unopened until the moment just prior to the bottle being filled.
2. During sampling, do not touch the threads on the cap, the inside of the cap or the neck of the bottle. Do not touch the inside of the bottle.
3. Do not place the cap on the ground while taking sample.

c) Important: Do not rinse the bottle before collecting the sample! Normally, sodium thiosulfate is added to the bottle to neutralize residual chlorine in the water sample.

d) Hold the bottle near its base, fill the bottle ~4/5 full, and replace the cap immediately. **Do not overfill!**

e) Complete the collection form and return the form and sample to the laboratory.

4.1.3 Response to Positive Microbiological Result:

a) If any routine microbiological sample is total coliform positive, but not fecal coliform or E.coli positive, collect four repeat samples from each well that tested positive. The first sample should be collected as soon as possible, but no later than 24 hours after receiving notice of a positive result. The remaining samples must be collected on the same day unless the Department allows the remaining samples to be collected over a four-day period. If the repeat samples show an absence of bacteria, the well may remain open or be opened for public use. If any of the repeat samples are total coliform or E. coli positive, the well must be taken out of service by removing the pump handle to prevent public access as soon as possible, but no later than 24 hours after receiving notice of a repeat sample positive result. If any repeat samples are total

coliform or E. coli positive, the well must be disinfected and retested according to d) below. If any of the repeat samples taken due to a positive **monthly** sample are E.coli positive, take samples according to c) below.

b) If any routine microbiological sample result is fecal coliform or E.coli positive, collect four repeat samples from each well that tested positive as soon as possible, but no later than 24 hours after receiving notice of a positive result. The well must be taken out of service by removing the pump handle to prevent public access as soon as possible, but no later than 24 hours after receiving notice of a fecal coliform or E.coli positive routine microbiological result. The well must be disinfected and retested according to d) below. If any of the repeat samples taken due to a positive **monthly** sample are E.coli positive take samples according to c) below.

c) If any repeat microbiological sample taken as a result of a positive monthly routine sample is E.coli positive, take 5 confirmation samples from each well that tested positive unless the Department requires immediate corrective action. If no immediate corrective action is required, the five confirmation samples must be collected within 24 hours after receiving notice of the repeat E.coli positive sample. If any of the five confirmation samples are E.coli positive corrective action will be required.

d) After any fecal coliform/E-coli positive routine sample or total coliform or E. coli positive repeat sample, all wells that tested positive must be disinfected, flushed and re-tested prior to opening to the public. The well must be disinfected and flushed in accordance with Section 4.3.4 below. After disinfection and flushing take at least one microbiological sample and remove the pump handle until the result(s) are received. If all microbiological samples taken after disinfection and flushing are absent of bacteria, the well may be opened for public use. If any microbiological sample is total coliform positive, keep the well closed and request a sanitary survey. Issues identified during the Sanitary Survey must be corrected. Once corrected, or if no issues are identified, disinfect and flush the well, then take one microbiological sample. If the microbiological sample is absent of bacteria, the well may be opened for public use.

e) If any routine sample is total coliform/E.coli positive take five routine samples during the next month the well provides water to the public with the first routine sample taken within the first week of the month.

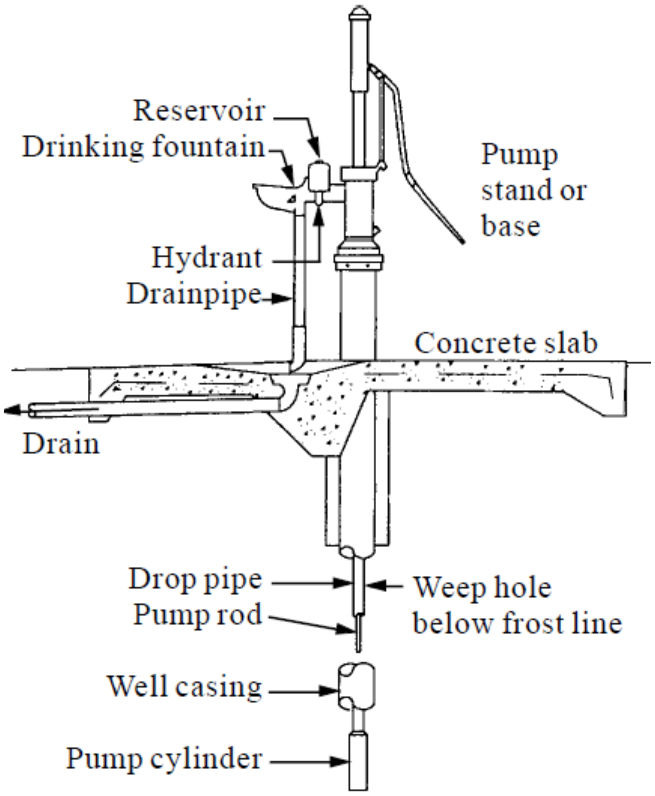
4.2 Nitrate and Nitrite Quality: Nitrate and Nitrite samples must be analyzed by a Department certified laboratory and all routine and confirmation sample results must be submitted to the Department in accordance with the Colorado Primary Drinking Water Regulations. The samples must be taken prior to opening the source for public use, typically during the "Start-Up" process. Repeat monitoring, analytical requirements, and response to violations must be in accordance with the Colorado Primary Drinking Water Regulations.

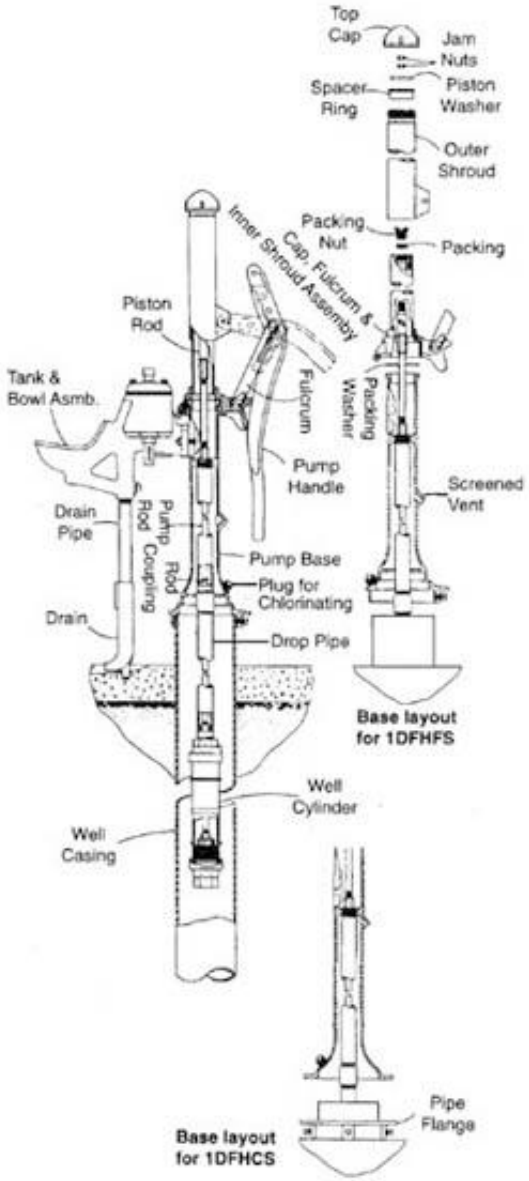
4.3 Public Notice, Wellhead Inspection, Start-up, Disinfection of the Well, Well Cleaning or Flushing, Shut-down, and Record Keeping

4.3.1 Public Notice: A public notice must be posted on or within sight of a hand-pumped well whenever the well is available for use to serve water to the public. The notice must state the following: "**<u>This hand pump serves unchlorinated well water.</u>** For more information, please contact [phone number of public water system owner, operator, or designee of the public water system.]". Additionally in the case of an MCL violation public notice must be distributed as directed by the Department.

4.3.2 Wellhead Inspection: A Wellhead Inspection must be performed on each hand pump installation before system start-up and after the system is shut-down. Year-round sites that have hand pumps must have a Wellhead Inspection performed at least once a year during the busiest month of operation. A Wellhead Inspection is simply a physical inspection of the hand pump, well seal, and surrounding well area. Minimum items to be checked on a wellhead inspection are summarized below.

a) Drainage system should be clear of any debris and functioning properly.
b) The sanitary well seal must be secure, in place, and watertight.
c) Concrete slab should not be cracked and any burrows under this slab must be filled. Ensure a tight seal (no gaps) between wellhead and concrete slab.
d) Nuts and bolts tight, gaskets intact at watertight joints.
e) Pump stand and major components not cracked or broken.
f) Packing nut and packing checked for wear; hole in packing nut not worn oblong; packing nut not bottomed out because packing worn out. Check condition of the upper piston guide on models with such appurtenances (e.g. 1DFHF and 1DFHC pumps).
g) Weep hole open (verify by demonstration, visual verification is not necessary).
h) Area around the well is clear of potential sources of contamination.





Note: Performing a Wellhead Inspection in the fall after the system has been shut-down is useful in identifying maintenance items that must be corrected before the system is opened for the next season. Materials can be ordered during the winter to be on hand for installation early next season. A Wellhead Inspection performed before system start-up can determine if any additional damage has occurred during the winter from vandalism, frost action, etc. **Problems noted during the Wellhead Inspection are considered to be sanitary defects. These defects are to be corrected prior to any further public use. Correction of the sanitary defects must be noted in the O&M records.**

4.3.3 Start-up Procedures:

a) Perform Wellhead Inspection (see section 4.3.2).
b) Complete necessary maintenance and repairs.
c) Install pump handle.
d) Loosen and readjust packing nuts as necessary (e.g. Monitor 1DFHC and 1DFHF pump stands). Add packing if necessary.
e) Flush well by pumping until discharge is clear of rust, sediment, etc.
f) Disinfect and flush the well in accordance to 4.3.4 below, no more than 30 days prior to opening for the season.
g) Collect any required Nitrate and Nitrite samples prior to opening.
h) Collect a routine microbiological sample at least 10 days prior to opening.
i) If the preopening routine sample shows an absence of bacteria, start up procedure may continue. If the preopening routine sample is total coliform positive, keep the pump handle off and comply with Section 4.1.3 a) thru d).
j) Once the well is free of contamination, reinstall the pump handle.
k) Ensure that the public notice detailed in Section 4.3.1 is posted and legible.
l) Collect the first monthly routine sample within the first seven days that the system is open for public use.
m) Maintain records to demonstrate that the procedures were followed.

4.3.4 Disinfection of the Well: For seasonally operated wells, the well water, pump and piping must be disinfected within 30 days of opening for the season. Wells that operate year round must disinfect at least once a year during the busiest month of operation prior to monthly routine microbiological sampling. Additionally the well water, pump and piping should be disinfected whenever the pump stand is raised or removed for maintenance. If the pump stand is raised, disinfection must include washing the exterior surface of the drop pipe and pump cylinder in addition to dosing the well and disinfecting the water, wetted casing, drop pipe and pump internals, as described in 4.3.4 a)-f). In all other scenarios including annual disinfection and disinfection as a response to positive microbiological samples, systems with a hand pump that allows disinfection without raising or removing the pump stand may disinfect by dosing the well and disinfecting the water, wetted casing, drop pipe and pump internals, as described in 4.3.4 b)-f), excluding 4.3.4 a).

a) *To wash the exterior when the pump stand is raised or removed* - Wash the exterior surface of the drop pipe and pump cylinder with a 100-mg/L-chlorine solution as they are lowered into the well. **NOTE:** 1 cup of 5-1/4 percent household bleach per five gallons of water is approximately a 100-mg/L-chlorine solution. Ensure that the bleach being used has not passed its expiration date.
b) Pour chlorine solution into well (just before installing pump cylinder and drop pipe assembly if they have been removed). Chlorine solution is made by adding one cup of 5-1/4 percent chlorine bleach to 5 gallons of clear water. Add 5 gallons of this solution into the well for each 20 feet of standing water, e.g. 15 gal for 60 feet of standing water. Disperse chlorine evenly through the well by

pouring chlorine solution through a disinfected hose or pipe that is moving up or down in the well while the chlorine solution is added.

c) After installation of the hand pump is complete, operate the hand pump until the distinct odor of chlorine is detected in the discharge.
d) Remove the pump handle and allow the chlorine solution to remain in the well for a minimum of 12 hours, preferably 24 hours.
e) Reinstall the pump handle and flush the well until the free chlorine residual is below 0.2 mg/L. Chlorine residual must be measured with an approved chlorine test kit.
f) Remove pump handle. Handle may be reinstalled for sampling purposes; however the well must remain closed until sample results show an absence of bacteria.

4.3.5 Well Cleaning or Flushing: Some wells are not adequately cleaned at the low pumping rate of hand pumps. Accumulations of sediment, rust particles, etc., eventually may affect the physical quality of the well water. At some sites, periodic cleaning of the well can be beneficial. The Operator-in-Responsible Charge should consult with facilities engineers on specific installations.

4.3.6 Shut-down:

a) Perform Wellhead Inspection (see Section 4.3.2)
b) Inspect packing nut on pump stands for tightness, where applicable, so packing forms a watertight seal while the hand pump is shut down for the season.
c) Remove pump handle.

4.3.7 Recordkeeping: Keep accurate records of analytical results, Wellhead Inspections, operations, maintenance and any specific problems for each system in official water system file. Each public water system must retain on the system's premises, or at a convenient location near such premises, the following records:

a) Records of microbiological analyses for not less than five years.
b) Records of chemical analyses for not less than ten years.
c) For each violation of the Colorado Primary Drinking Water Regulations, the records of action taken by the public water system to correct the violation for not less than three years after the date on which the last action was taken with respect to the particular violation involved.
d) Copies of any written reports, summaries or communications relating to sanitary surveys for not less than ten years after completion of the sanitary survey.
e) All records pertaining to the monitoring and operation of a public water system under this Guidance must be kept for not less than ten years.
f) Documentation of corrective actions must be kept for a period of not less than ten years.